REMARKS

This application has been carefully reviewed in light of the final Office Action dated March 28, 2007. Claims 1, 4 to 12, 15 to 24, and 26 to 32 remain in the application, of which claims 1, 24, 31 and 32, the independent claims, have been amended herein. Reconsideration and further examination are respectfully requested.

Interview Summary

Initially, the Applicants' undersigned representative thanks Examiner Allison for the thoughtful courtesies and kind treatment afforded during the personal interview conducted on April 11, 2007. In the interview, the features recited by the independent claims were discussed in light of the applied references. At the conclusion of the interview, Examiner Allison suggested that the rejections based upon U.S. Patent No. 6,504,951 ("Luo") would be overcome if the claims were amended to recite the feature that a training set of pixels is "selected" via a user input, the training set of pixels including a portion of the first region, a portion of the second region, and the boundary. Furthermore, Examiner Allison graciously agreed that, for expediency, he would not issue a first action final office action if an RCE was filed concurrently with the above-noted claim amendments. Having amended the claims in accordance with the Examiner's suggestion, the Applicants respectfully request withdrawal of the rejections and further examination of the application.

Section 103 Rejections

In the Office Action, claims 1 to 3, 5 to 7, 13 to 16, 20, 25 and 31 were rejected under 35 U.S.C. § 103(a) over Luo in view of U.S. Patent No. 5,912,994 ("Norton"); claim 4 was rejected under 35 U.S.C. § 103(a) over Luo in view of Norton and U.S. Patent Application Publication No. 2003/0007683 ("Wang"); claims 8 to 12 were rejected under 35 U.S.C. § 103(a) over Luo in view of Norton and further in view of E. Littman and H. Ritter, "Adaptive Color Segmentation – A Comparison of Neural and Statistical Methods," IEEE TRANSACTIONS ON NEURAL NETWORKS, Vol. 8, No. 1, pp. 175-85 (Jan. 1997) ("Littman"); claims 17 to 19, 24, 26 to 30 and

32 were rejected under 35 U.S.C. § 103(a) over Luo in view of Norton and further in view of V. Boskovitz and H. Guterman, "An Adaptive Neuro-Fuzzy System for Automatic Image Segmentation and Edge Detection," IEEE TRANSACTIONS ON FUZZY SYSTEMS, Vol. 10, No. 2, pp. 247-61 (Apr. 2002) ("Boskovitz"); claims 21 was rejected under 35 U.S.C. § 103(a) over Luo in view of Norton and further in view of U.S. Patent Application Publication No. 2004/0170337 ("Simon"); and claim 23 was rejected under 35 U.S.C. § 103(a) over Luo in view of Norton and further in view of U.S. Patent Application Publication No. 2003/0063797 ("Mao"). Support for the newly-clarified features recited by the amended claims can be found at least at pages 4 to 6 of the specification, and FIGS. 1 and 2, for example. Withdrawal of the § 102 and § 103 rejections and further examination are respectfully requested.

According to the present disclosure, a boundary separating a first region and a second region of a digital image is defined, the digital image including one or more color arrangements characteristic of a first visual texture of the first region and one or more color arrangements characteristic of a second visual texture of the second region. A training set of pixels is selected via a user input, the training set of pixels including a portion of the first region, a portion of the second region, and the boundary, the training set of pixels exhibiting sample color arrangements associated with both the first and second visual textures, and a learning machine or neural network is trained to classify learning machine input sets based upon, *inter alia*, the training set, each learning machine input set including a pixel of interest and neighboring pixels. It is determined which pixels of the digital image satisfy criteria for classification as being associated with the first region and second region, by inputting, *inter alia*, the learning machine input sets each including the respective pixel of interest and the respective neighboring pixels, and outputting an indication of a region to which each of the pixels of interest belong.

Referring to particular claim language, independent claim 1 recites a method for defining a boundary separating a first region and a second region of a digital image, the digital image including one or more color arrangements characteristic of a first visual texture of the first region and one or more color arrangements characteristic of a second visual texture of the second region. The method includes selecting, via a user input, a training set of pixels including a portion of the first region, a portion of the second region, and the boundary, the training set of pixels exhibiting sample color arrangements associated with both the first and second visual

textures, and training a learning machine to classify learning machine input sets based upon the training set, each learning machine input set including a pixel of interest and neighboring pixels. The method also includes determining using the trained learning machine which pixels of the digital image satisfy criteria for classification as being associated with the first region and second region, by inputting the learning machine input sets each including the respective pixel of interest and the respective neighboring pixels, and outputting an indication of a region to which each of the pixels of interest belong. Moreover, the method includes identifying pixels of the digital image that are determined not to satisfy the criteria for classification as being associated either with the first region or the second region, and decontaminating the identified pixels to define the boundary between the first and second regions by separating pixels of the digital image into pixels associated with the first region, the second region, or the boundary.

Independent claim 24 recites a method for defining a boundary separating a first region and a second region of a digital image, the digital image including one or more color arrangements characteristic of a first visual texture of the first region and one or more color arrangements characteristic of a second visual texture of the second region. The method includes selecting, via a user input, a training set of pixels including a portion of the first region, a portion of the second region, and the boundary, the training set of pixels exhibiting sample color arrangements associated with both the first and second visual textures, and training a neural network to classify learning machine input sets based upon the training set, using backward propagation, each learning machine input set including a pixel of interest and neighboring pixels. The method also includes determining based on an output of a neural network which pixels of the digital image satisfy criteria for classification as associated with the first region and the second region, by inputting the learning machine input sets each including the respective pixel of interest and the respective neighboring pixels, and a location of the pixel of interest and outputting an indication of a region to which each of the pixels of interest belong. The neural network includes a gating node associated with a corresponding hidden node, the gating node being configured to determine, based on a location of the pixel of interest, a contribution the corresponding hidden node makes to the output of the neural network.

Independent claims 31 and 32 recite computer program products that substantially correspond to the methods recited by claims 1 and 24, respectively.

The applied art is not seen to disclose, teach, or to suggest the foregoing features recited by the independent claims. In particular, Luo, Norton and Boskovitz, either alone or in combination (assuming *arguendo* that such a combination were possible) are not seen to disclose, nor does the Office Action even assert that Luo, Norton and Boskovitz disclose, at least the features that: *i)* a training set of pixels is selected via a user input, the training set of pixels including a portion of the first region, a portion of the second region, and the boundary, the training set of pixels exhibiting sample color arrangements associated with both the first and second visual textures, or *ii)* determining which pixels of the digital image satisfy criteria for classification as being associated with the first region and second region, by inputting the learning machine input sets each including the respective pixel of interest and the respective neighboring pixels.

Luo discloses the detection of sky regions in an image, by comparing potential sky pixels with a predetermined desaturation gradient for sky. *See* Luo, col. 3, ll. 5 to 15; and Abstract. In particular, an input image is received, and pixels are classified into sky-colored and non sky-colored pixels. The color classifier is only seen to be pre-trained to detect a clear, light-blue sky seen at daytime, however, where color-based detection is merely to detect candidate blue sky pixels, which are consistent with clear sky. *See* Luo, col. 8, ll. 19 to 29. Since the initial training set for the color classifier is merely understood to include images having ideal blue sky characteristics, Luo is not seen to disclose at least the feature that the training set of pixels is *selected via a user input* which exhibits sample color arrangements associated with first and second visual textures. *See* Luo, col. 8, ll. 29 to 35. In fact, Luo teaches away from classifying images solely on the basis of textures, indicating that, in order to be robust, sky detection needs to go beyond the mere detection of textures since coloration or texture of subject matter may not differentiate true sky regions. *See* Luo, col. 4, ll. 27 to 34.

Furthermore, while it is true that the color classifier is trained to classify pixels with a belief value indicating the likelihood that a pixel is blue sky, it is also true that *each pixel is classified independently* based upon the characteristics of *that pixel*, as represented by the belief map. *See* Luo, col. 8, ll. 55 to 64. Accordingly, Luo is not seen to disclose that a neural network or a learning machine is trained to classify learning machine input sets based upon the training set, where each learning machine input set includes a pixel of interest *and neighboring*

pixels, in which it is determined which pixels of the digital image satisfy criteria for classification as associated with the first region and the second region by inputting learning machine input sets each including the respective pixel of interest *and the respective neighboring pixels*.

Norton is not seen to remedy the deficiencies of Luo. Specifically, Norton describes edge detection or region definition technology, in which masks are understood to be constructed based upon luminance values in a test area. *See* Norton, col. 2, ll. 15 to 25; and Abstract. However Norton is not seen to disclose, nor does the Office Action even assert that Norton discloses, at least the features that: *i)* a training set of pixels is selected via a user input, the training set of pixels including a portion of the first region, a portion of the second region, and the boundary, the training set of pixels exhibiting sample color arrangements associated with both the first and second visual textures, or *ii)* determining which pixels of the digital image satisfy criteria for classification as being associated with the first region and second region, by inputting the learning machine input sets each including the respective pixel of interest and the respective neighboring pixels.

Boskovitz is further not seen to remedy the deficiencies of either Luo or Norton, as it is merely successful in describing the existence of second order (three-by-three) or fifth order (seven-by-seven) pixel neighborhoods. Having established that these types of relationships may exist between pixels, Boskovitz is still not seen to assert, nor does the Office Action even assert that Boskovitz asserts, at least the features that: *i)* a training set of pixels is selected via a user input, the training set of pixels including a portion of the first region, a portion of the second region, and the boundary, the training set of pixels exhibiting sample color arrangements associated with both the first and second visual textures, or *ii)* determining which pixels of the digital image satisfy criteria for classification as being associated with the first region and second region, by inputting the learning machine input sets each including the respective pixel of interest and the respective neighboring pixels.

Accordingly, based on the foregoing amendments and remarks, independent claims 1, 24, 31 and 32 are each believed to be allowable over the applied references. The other rejected claims in the application are each dependent on these independent claims and are believed to be allowable for at least the same reasons. Because each dependent claim is deemed to define an

additional aspect of the disclosure, individual consideration of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

By responding in the foregoing remarks only to particular positions taken by the examiner, the Applicant does not acquiesce with other positions that have not been explicitly addressed. In addition, the Applicant's arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

No fees are believed to be due at this time. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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